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**Children's Beliefs about Animal Minds (Child-BAM): Associations with Positive and Negative Child-Animal Interactions**

**Running title:** CHILDREN'S BELIEFS ABOUT ANIMAL MINDS

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**Abstract**

Children and animals can have a great impact on each other's lives, yet little is known about the underpinnings of these relationships. Children's interactions with animals may be influenced by their belief in animal minds, that animals are sentient and experience thoughts and feelings. This study introduces a newly developed measure of children's beliefs about animal minds (Child-BAM) and investigates associations between Child-BAM and factors relating to positive and negative interactions with animals. Using a questionnaire-based survey of over one thousand 6 to 13 year-olds in the UK, the results show that Child-BAM was associated with higher attachment to pets ( $p < 0.001$ ), compassion ( $p < 0.001$ ), humane

( $p < 0.001$ ) and caring behaviour ( $p < 0.001$ ) towards animals, emotional attachment to animals ( $p = 0.003$ ) and positive attitudes towards animals ( $p < 0.001$ ). Child-BAM was also associated with less acceptance of intentional animal cruelty ( $p = 0.001$ ), unintentional animal cruelty ( $p = 0.007$ ), and animal neglect ( $p = 0.01$ ). There was a significant difference in Child-BAM between children with pets ( $p = 0.014$ ), children who had a pet of their own ( $p = 0.016$ ), and age group ( $p < 0.001$ ). This study enhances our understanding of the psychological underpinnings of child-animal relationships and highlights the implications for animal welfare education and for preventing childhood animal cruelty.

Key words: animal emotion, animal welfare, beliefs about animal mind, children, preventing animal cruelty

## Introduction

The relationship between humans and animals is multi-layered and complex; there are many inter-related factors that shape these relationships. Although research interest is expanding, child and animal relationships remain under-researched, which is surprising given the significant impact animals can have on children's lives (Melson 2003) and vice versa (Muldoon et al. 2009). It is important to conduct research into the 'complex web' of factors that influence these relationships, both positively and negatively, to promote humane animal treatment.

Human-animal interactions are affected by beliefs about animal mind (Davis and Cheeke 1998). Beliefs about animal mind (BAM), that is, believing that non-human animals have the ability to think, feel and experience emotions, is arguably the most important cognitive domain (affective empathy being the most important emotional domain)

influencing the moral status of animals (Sorabji 1995), attitudes towards animals and subsequent animal welfare (Ellingsen et al. 2010). There appears to be widespread belief in the emotional lives of animals, especially among adult pet owners (Morris, Knight and Lesley 2012). Emotions in animals are often seen as ‘common sense’ (Katcher 1981). However, we still have little understanding regarding the role of BAM in children-animal relationships.

Scientific research demonstrating the cognitive and emotional capabilities of a wide range of animals continues to expand, such as language and cognition in non-human apes (Rumbaugh 2014), morality in sperm whales (Peterson 2011) prosocial behaviour in rats (Bartal, Decety and Mason 2011; Bartal et al. 2014) and cognitive complexities in fish (Brown 2015). This increase in research, as well as increased public interest in animal cognition over the past 20 years or so, may be affecting public attitudes towards animals. For example, the recent case of whether human rights should be granted to chimpanzees (Foster 2015) and increased concern for farm animal welfare due to the rapid progression of research on farm animal sentience (Boissy and Lee 2014). Attributing mental states to animals, or believing animals are sentient, appears to be commonplace and cross-cultural but may depend on species (Eddy, Gallup and Povinelli 1993), personal relevance, social identity and group membership (Fraser et al. 2013; Morris, Knight and Lesley 2012). “Animal welfarists” for example, may be more likely to believe in animal minds than laypersons or scientists (Knight et al. 2009).

BAM is strongly related with concern for animals (Herzog and Galvin 1997), caring behaviour (Kielland et al. 2008; Ellingsen et al. 2010), and can affect empathy and attitudes towards animals (Hills 1995; Knight et al. 2004). Believing that animals are sentient introduces moral dilemmas, such as whether animal experimentation is acceptable. BAM positively correlates with concern for animal welfare among adults (Broida et al. 1993) and may affect how children interact and treat particular animals (Burghardt 2009). Believing

animals are insentient may lead to negative behaviours towards animals (Knight et al. 2004), thus compromising animal welfare.

BAM involves attributing animals with mental capacities (Eddy, Gallup and Povinelli 1993). Myers (1998) observed that even young children have a basic BAM. Research on the theory of mind (ToM) shows that by the age of four, children have a range of concepts relating to human minds including an understanding of desires, the origins of knowledge, that people may have false beliefs, and later in development children begin to understand personality differences and unobservable cognitive processes (Burke and Williams 2009; Lim et al. 2010; Saracho 2014). Understanding of minds may depend on skill development and interaction experiences (Dennett 1978), which may explain why pets are commonly perceived to have higher cognitive capacities than other animals (Maust-Mohl, Fraser and Morrison 2012). Children may over-estimate animal minds in those they perceive as similar, familiar or phylogenetically closer to humans (Lockard 1971; Knight et al. 2004) and anthropomorphism (attributing human characteristics to non-human animals) may affect how children rate animals on sentience (Collins 2012). These judgements may be based on inappropriate criteria such as positive or negative emotional feelings towards particular species. A lack of understanding of animal's experiences can lead to inappropriate attitudes and behaviour (Staub 1987).

Hills (1995) advocates focusing education on improving understandings of animal's mental capabilities and thereby "capitalizing on the motivational power of feelings" (p.141). Knight et al. (2004) also states that research should acknowledge the importance of BAM. However, very few studies have investigated children's BAM and the influence this has on their relationships with animals. Exploring how young children develop ideas about animal minds will enable us to comprehend and explore how society's treatment of animals may be influenced (Okamoto 2001).

98           This study explores associations between Child-BAM and factors relating to positive  
99   and negative interactions with animals. We hypothesised that higher Child-BAM would be  
100   related to higher attachment and compassion towards animals, positive attitudes towards  
101   animals, reported humane behaviour and would be associated with less acceptance of animal  
102   cruelty. It was also hypothesised that children with pets would have higher BAM.

103           A range of experiential and development influences may affect children's BAM.  
104   These include pet ownership (Cain 1985; Driscoll 1992; Sanders 2003; Morris, Knight and  
105   Lesley 2012; Wilkins, McCrae and McBride 2015). For example, pet owners are more likely  
106   to report a wider range of emotions across species than those who do not have pets (Morris,  
107   Knight and Lesley 2012; Wilkins, McCrae and McBride 2015). Demographic factors may  
108   also affect children's BAM. Research has shown that females are more emotionally receptive  
109   than males (Hoffmann et al. 2010; Whittle et al. 2011) and score higher on BAM than males  
110   (Herzog and Galvin 1997; Nakajima, Arimitsu and Lattal 2002). Research has also found a  
111   positive relationship between age and BAM (Knight et al. 2004), and that adults from urban  
112   areas displayed more positive attitudes towards animals but less welfare knowledge about  
113   farm animals (Kalof et al. 1999), with similar findings in children (Burich and Williams,  
114   under review). Most of the previous research is with adults and so we aimed to identify  
115   sociodemographic variables that may influence children's BAM including gender, age, pet  
116   ownership, family affluence and area of residence.

117   We aimed to answer four primary research questions:

- 118           1) Is there a relationship between Child-BAM and children's attachment,  
119           compassion, reported humane behaviour and attitudes towards animals?

- 2) Is there a relationship between Child-BAM and children's attitudes towards animal cruelty?
- 3) Are there age, gender and demographic differences in Child-BAM?
- 4) Are there differences in Child-BAM between children with or without pets?

## Methods

### *Participants and Procedure*

Participants included 1,217 (51% boys, 49% girls) primary school children from 24 schools across Scotland UK. Children were aged between 6 and 13 years old ( $M=9.7$ ,  $SD=1$ , range 6.4-12.2) and grouped into two age groups for the purpose of analysis, 6-9 years (52.8%) and 10-13 years (47.2%). The majority of children had pets (67%) and had a pet of their own (54%). The types of pets included: dogs (35%), cats (22%), small mammals (18%), fish/reptiles/amphibians (21%), birds (2%) and other (4%). A self-complete questionnaire, comprising of a total of 35 questions (approximately 15 minutes to complete), was administered to the children during class time by school teachers. Each child completed the questionnaire individually at their classroom desks and could ask for help from a teacher if they had difficulty reading or understanding any of the questions. The questionnaire used appropriate terminology for the age group and a pilot study with three schools ( $n=128$ ) confirmed its suitability.

Questionnaires were either mailed or hand delivered to schools, following completion the sealed questionnaires were either collected in person or sent by mail and then stored securely within the University. All information was treated confidentially and kept secure at all times; child and school data were anonymised during data preparation by adopting identity numbers.



The ethical guidelines of the British Psychological Society, specifically relating to research with children, was adopted for this research and ethical consent was granted from the University of Edinburgh's Clinical and Health Psychology ethics committee. Permission was sought from each local authority before schools were contacted. School participation was at the head teacher's discretion and parental consent and child assent were obtained.

### *Measures*

*Child-BAM:* As there is no consistent measure of BAM for adults, and no existing measure for children, the Child-BAM (Children's Beliefs about Animal Minds) was developed from a measure of adult's perceptions of animal mentality (see Rasmussen, Rajecki and Craft 1993; Hills 1995). Each scale (e.g. "do you think the following animals are ....?") related to a specific sentience item (clever/pain/happiness/sadness/fear). The emotions selected were those children would have familiarity and understanding of in relation to humans and have relevance to a wide range of species. These questions were asked in relation to eight animals (dog/cow/human/robin/frog/badger/chimpanzee/goldfish). These animals represent a range of domestic, farm and wild animals, on a scale of phylogenetic similarity to humans. These specific animals were also chosen based on familiarity among UK children. Animals that may have negative connotations for children (Borgi and Cirulli 2015) such as snakes were not included as this may affect BAM scores. Each item was scored on a 5-point Likert scale ("strongly agree"- "strongly disagree"). Overall Child-BAM scores were calculated for each participant using the total score from each item (minimum score 40, maximum score 200),  $\alpha = 0.92$ .

*Attachment to Pets (SAPS):* The Short Attachment to Pets Scale for Children and Young People, developed and validated by Marsa-Sambola et al. (2015), was used to measure attachment to pets. One 9-item scale asked children to "please tell us how you feel about your

favourite pet animal” with nine statements e.g. “I love pets” and “I consider my pet to be a friend (or would if I had one)”. Each item was scored on a 5-point Likert scale (“strongly agree”-“strongly disagree”). Total scores were calculated (minimum score 9, maximum score 45).  $\alpha = 0.85$ .

*Children’s Compassion towards Animals (CCA)*: A new measure of compassion to animals for children was developed comprising one 5-item scale asking “what do you think about animals?” with five statements e.g. “when I see an animal that is hurt or upset I feel upset” and “when I see an animal that is hurt or upset I want to help it”. There are currently no measures of compassion to animals for children. To develop this new scale we drew on human self-compassion measures literature (e.g. Neff 2003). Adaptations included rewording to focus on compassion to animals and reducing the number of items to achieve child-appropriateness. The measure is scored on a 5-point Likert scale (“strongly agree”-“strongly disagree”). Total scores were calculated (minimum score 5, maximum score 25).  $\alpha = 0.7$ .

*Children’s Reported Humane Behaviour towards Animals (CRHBA)*: The humane behaviour measure was adapted from a combination of the Children’s Treatment of Animals Questionnaire (Thompson and Gullone 2003) and the Lexington Attachment to Pets Scale (Johnson, Garrity and Stallones 1992). One 12-item scale asked children “how often do you do the following things with or for your pet animal(s) (or would if you had one)?” for each of 12 statements e.g. “play with”, “cuddle” and “talk to”. Each statement is scored on a scale of 1-4 (“often”, “sometimes”, “never” and “I cannot do this with my animal”). Total scores were calculated (minimum score 12, maximum score 48).  $\alpha = 0.84$ .

Initial analysis using principal components analysis (PCA) extracted three components from the humane behaviour variables explaining 58.7% of the overall variance (Table 1). Component one, explaining 31.11% of the variance, was labelled “caring

behaviour towards animals”. Component two, explaining 18.35% of the variance, was labelled “emotional attachment to animals”. Component three, explaining 9.23% of the variance, was labelled “aggression towards pets”. These three subscales were used in subsequent statistical analysis.

[insert Table 1 here]

*Attitudes towards Animals:* This measure was adapted from the Pet Attitude Scale (see Munsell et al. 2004; Daly and Morton 2006). This is a 28-item scale, nine items relating to pet animals (e.g. “all pet animals should be cared for by humans”), eight relating to wild animals (e.g. “wild animals should live free in the wild”) and 11 relating to farm animals (e.g. “I don’t care about farm animals”), each scored on a 5-point Likert scale (“strongly agree”-“strongly disagree”). An overall total score for attitudes towards animals was calculated (minimum 28, maximum 140), as well as subtotals for each type of animal (pet/wild/farm).  $\alpha = 0.72$ .

*Children’s Attitudes towards Animal Cruelty (CAAC):* This measure, adapted from Connor, Williams and Lawrence (2014), is an 11-item scale where children are asked “how acceptable do you think it is to..?” with 11 behaviours e.g. “kill an animal” (See Hawkins and Williams, in preparation). These include deliberate cruelty (e.g. “hurt an animal on purpose”), accidental cruelty (e.g. “kick an animal by accident”), and animal neglect (e.g. “forget to feed a pet”). Items were scored on a 5-point Likert scale (“not acceptable at all”-“very acceptable”). A total score was calculated (minimum 11, maximum 55).  $\alpha = 0.7$ .

Initial analysis using PCA extracted three components from the 11 animal cruelty variables explaining 59.07% of the overall variance (Table 2). Component one, explaining 24.91% of the variance, was labelled “intentional animal cruelty”. Component two,

explaining 17.57% of the variance, was labelled “unintentional animal cruelty”. Component three, explaining 16.59% of the variance, was labelled “animal neglect”. The subscales were used in subsequent statistical analysis.

[insert Table 2 here]

*Family Affluence and Pet Ownership:* The validated Family Affluence Scale (II; Currie et al. 2008) was included to measure family wealth. This scale comprises of four questions: 1) does your family own a car, van or truck? 2) Do you have your own bedroom for yourself? 3) During the past 12 months, how many times did you travel away on holiday with your family? 4) How many computers does your family own? A composite FAS II score was calculated ( $\alpha=0.33$ ). The pet ownership questions were adapted from the Childhood Pet Ownership Questionnaire (Paul and Serpell 1993). These questions related to current ownership of pets, types of pets, the number of pets in the household and whether there was a pet that the child considered to be their own.

The full versions of the scales are available from the first author upon request.

## Results

Data that did not conform to parametric assumptions were transformed using logarithms (base 10 log). Paired-sample T-tests examined statistical differences in Child-BAM scores between animals. Table 3 displays the order in which children rated animals as sentient. Children rated dogs as the most sentient above all other animals except humans, whereas goldfish and frogs were rated as the least sentient. All paired differences for ratings

of intelligence, pain, happiness and sadness were significant ( $p<0.05$ ). All paired differences for ratings of fear were significant, except for goldfish and frogs ( $p=0.063$ ), and badgers and cows ( $p=0.93$ ).

[insert Table 3 here]

*1) Is there a relationship between Child-BAM and children's attachment, compassion, reported humane behaviour and attitudes towards animals?*

Linear regression analysis (see Table 4) found that higher Child-BAM significantly but weakly predicted higher: attachment to pets, compassion, reported humane behaviour, caring behaviour, emotional attachment, and attitudes towards wild animals. Child-BAM was significantly but weakly predicted by positive attitudes towards animals and pets.

*1) Is there a relationship between Child-BAM and children's attitudes towards animal cruelty?*

Linear regression analysis (see Table 4) found that Child-BAM significantly but weakly predicted CAAC, intentional animal cruelty, unintentional animal cruelty and animal neglect. Lower Child-BAM was associated with higher acceptance of animal cruelty, including intentional, unintentional animal cruelty and animal neglect.

*2) Are there age, gender and demographic differences in Child-BAM?*

Independent T-Test analysis showed that older children (10-13 years) scored significantly higher on Child-BAM than younger children (6-9 years) ( $t(1084)=4.39$ ,  $p<0.001$ ,  $d=0.3$ ). There was no significant difference in Child-BAM between boys and girls ( $t(1124)=0.93$ ,  $p=0.36$ ,  $d=0.06$ ).

One-way ANOVA found an initial significant difference between area of residence ( $F(4,1119)=3.2, p=0.013, n^2=0.01$ ) but no significant difference was found following Bonferroni post-hoc analysis. Linear regression analysis (Table 4) found no significant relationship between Child-BAM and family affluence.

3) *Are there differences in Child-BAM between children with or without pets?*

Independent T-Test analysis revealed that children who had a pet of their own scored higher on Child-BAM than children without a pet of their own ( $t(1111)=-2.41, p=0.016, d=0.1$ ). One-way ANOVA found that Child-BAM significantly differed depending on the number of pets currently living in the child's home ( $F(3,1120)=3.59, p=0.013, n^2=0.01$ ). Bonferroni post-hoc showed that children with two or more pets scored higher on Child-BAM compared to children with no pets ( $p=0.007$ ). No significant difference was found for children with one or two pets ( $p>0.05, ns$ ), or between children who had or did not have particular types of pets (all  $p>0.05, ns$ ).

Independent T-Tests analysis showed that children who had pet dogs rated dogs higher on sentience compared to children who did not have pet dogs ( $t(907)=2.88, p=0.004, d=0.2$ ). However, children with pet birds did not rate robins higher on sentience compared to children without pet birds ( $t(1183)=0.87, p=0.38, d=0.05$ ), similarly with pet fish ( $t(1174)=0.1, p=0.92, d=0.01$ ).

One-way ANOVA revealed that children scored higher on Child-BAM if they: believed their pet was their friend, their pet made them feel happy, they liked animals, they talked to their pets a lot, they spent time everyday playing with their pets and if they felt that there are times they would be lonely without their pet (see Table 5). Children scored higher on Child-BAM if they did the following things often with their pet/s (or would if they had one): played with, took for a walk, patted/stroked, cuddled, cried with, groomed, told secrets

to and spent time with (see Table 6). Spending more time with pets as well as having a close relationship to pets therefore increases Child-BAM.

[insert Tables 4, 5 and 6 here]

## Discussion

We set out to study associations between Child-BAM and factors relating to positive and negative interactions with animals. The results from the study confirmed the hypothesis that Child-BAM is positively related to attachment to pets and compassion to animals, humane behaviour towards animals, as well as attitudes towards animals. The findings also confirmed that Child-BAM was negatively associated with acceptance of intentional and unintentional animal cruelty and animal neglect. Children with pets and those with close relationships with their pets, scored higher on Child-BAM. All effect sizes were small (Cohen 1988; Miles and Shevlin, 2001). No gender or demographic differences were found. However, there was a significant developmental trend where older children scored higher on Child-BAM.

It was promising that Child-BAM positively related to attachment, given that attachment to pets has been related to positive attitudes towards animals, more pro-social behaviour and the development of empathy among children (Poresky and Hendrix 1990; Knight et al. 2004; Kruger McCune and Merrill 2012). The results of our study are consistent with previous findings (for example, Hills 1995) that BAM may be linked to positive human-animal relationships, which has positive implications for animal welfare and animal-related education.

Cognitive judgements of similarity or familiarity can determine perceptions of animals and empathic response (Hornstein 1976; Hoffman 1984; Fenton and Hills 1988), particularly in regards to mental capabilities (Plous 1993). This may be linked with children's education, 'naïve biology' or use of 'personification' (Carey 1985; Hatano and Inagaki 2002). Children use humans as their most familiar exemplar of biological entities to compare to other animals; in other words, children may project human properties onto animals when attempting to understand their minds and behaviour and so are more likely to rate animals phylogenetically closer to humans higher on sentience (Eddy, Gallup and Povinelli 1993; Wilkins, McCrae and McBride 2015; Borgi and Cirulli 2015). However, this was not the case in the present study, instead children's emotional connections to species seems to have been most salient in their BAM scores. Although birds, frogs, badgers and cows were always rated lower on sentience, children rated dogs higher than chimpanzees for all sentience items. This finding is consistent with previous research that dogs are rated highly on sentience (Morris, Knight and Lesley 2012) and are perceived as possessing similar mental processes as humans (Rasmussen, Rajecki and Craft 1993). One possible explanation of our finding is that children within this age group may have less familiarity, or may lack the necessary cognitive maturity to understand complex emotions in a diverse range of animals, including chimpanzees. In a different study, older children were more likely to rate animals as sentient compared to younger children, especially for chimpanzees, dogs, and dolphins; younger children were more likely to rate animals such as rabbits, rats, pigs and goldfish as more sentient (Okamoto 2001). Similarly, young adults rate primates as more intelligent than dogs and cats (Furnham and Heyes 1993). Knowledge about animal sentience may be taught to children over time, either through informal learning (e.g. experience and social learning) or through instruction (e.g. school input on animals and nature). Child-BAM may also be linked to cognitive developmental processes (e.g. Theory of Mind) and so the cognitive ability to understand a



variety of emotions in a variety of animal species may develop with age. Our study seems to be consistent with previous findings that BAM increases with age (Knight et al. 2004) and that mental attribution in general becomes more complex with age (Baron-Cohen 2003). If Child-BAM is linked to knowledge, then education may be the key to increasing BAM, which may result in more positive child-animal interactions.

In the current study, pet ownership was common, 67% of the children reported having a pet and 54% reported having a pet of their own. As expected, children scored higher on Child-BAM if they had pets, particularly if they had a pet of their own or had two or more pets, rather than the type of pet. The ‘contact hypothesis’, which states that direct contact can lead to shared positive experiences and attachment (Allport 1954), may explain why pet owners scored higher on Child-BAM. Children with pet dogs rated dogs higher on sentience compared to children who did not have pet dogs, which is consistent with previous research that more emotions are reported in species that are kept as pets (Morris, Knight and Lesley 2012; Walker et al. 2014), although this was not found for birds or fish. Emotional bonding and a sense of oneness (Staub 1987) may have a positive effect on child-animal relationships and Child-BAM, which may explain the results for pet ownership.

Many children have close emotional relationships with their pets (Melson 2003) and the bond between people and their pets may “facilitate a connection to animals and acceptance of cognitive abilities through their interactions and emotional attachment” (Maust-Mohl, Fraser and Morrison 2012, p.114). The present findings indicate that Child-BAM may be related to caring behaviour towards animals and feelings of emotional attachment towards animals. Child-BAM may be related to social engagement with animals (Carporel and Heyes 1997), affection and a close relationship with animals (Kiesler, Lee and Kramer 2007), rather than pet ownership alone (Morris, Knight and Lesley 2012). Paul and Serpell (1993) suggested that experience of animals should be measured in terms of quality of

relationships, viewing an animal as a friend rather than contact alone. Walker et al. (2014) recommended that future research distinguish “owner” from “care-giver”. The current study provides new evidence on the quality of child-pet relationships; spending quality time with and having close connections to pets, rather than contact alone, is associated with higher Child-BAM. It should be noted that we cannot make conclusions regarding the direction of the relationship between pet ownership, pet care and Child-BAM. Future research could explore this further to determine whether children with pets learn about animal minds through experience, or whether children with high BAM have more motivation for the acquisition of a pet.

A key finding to highlight from the current study is that children were less accepting of animal cruelty if they scored higher on Child-BAM; this included intentional cruelty, unintentional cruelty, and animal neglect. Although it is important to emphasise that these associations were weak and that further research is required. These findings are important given that they highlight that Child-BAM may be negatively related to all types of animal cruelty. The median onset age of childhood animal cruelty is 6 and half years (Frick et al. 1993) and so early prevention may be beneficial (Ascione 1993; Gullone 2014). It is important to note that BAM may be one of many inter-related factors that could affect whether a child is cruel to an animal (for a systematic review see Hawkins, Hawkins and Williams, in press). Children who are cruel to animals may believe animals are sentient, but their behaviour has been distorted for other reasons such as learning cruelty through social learning or adverse childhood experiences (Ascione 1993; Baldry 2005; Duncan, Thomas and Miller 2005; Gullone and Robertson 2008). However, no research to date has examined how Child-BAM may or may not link to animal cruelty behaviour. This will be an important new avenue of research for childhood animal cruelty prevention.

Despite these limitations, it seems hopeful that teaching children about animal emotions and cognition may lead to positive impacts on animal welfare, and indeed some research has demonstrated this. An animal-focused course where students were made aware of animal minds, led to an increase in pro-animal attitudes and concern for animals and their natural habitats (Helton and Helton 2005). Furthermore, an increase was found in children's BAM following participation in an animal welfare education programme alongside a decrease in acceptance of animal cruelty (Hawkins, Williams & Scottish SPCA, under review). Interventions that promote positive child-animal relationships and aim to prevent animal cruelty could benefit from incorporating teaching material about animal minds into their programmes.

There seems to be a disconnection between scientific research and the general public's understanding of animal minds. Maust-Mohl, Fraser and Morrison (2012) for example, found that non-scientists seem to lack understanding of animal cognitive abilities but are open to new ideas and express excitement about seeking further information. Children also express a great interest in animals (Melson and Melson 2009; Muldoon, Williams and Lawrence 2015) and hold beliefs about animal minds. Fraser et al. (2013) argue that animal cognition researchers, social scientists, animal welfare organisations, and educators, should collaborate to enhance public understanding of animal minds. Child-friendly education materials could be developed and distributed throughout schools, zoos, or wildlife and/or animal parks and scientifically evaluated to enhance their effectiveness.

No difference in Child-BAM was found for gender, family affluence or area of residence in the current study, although other researchers have found that higher levels of education (Mariti et al. 2011), and adults from urban backgrounds display more positive attitudes towards animals (Bjerke, Ødegårdstuen and Kaltenborn 1998; Kalof et al. 1999; Vanhonacker et al. 2010). There may also be cultural differences in BAM (e.g. Nakajimi,

Arimitsu and Lattal 2002) and so this study cannot be generalised to other cultures; the Child-BAM measure may need to be tailored to the country in which it is administered. There seem to be conflicting findings for gender differences in BAM but little research has provided evidence for gender differences in BAM (e.g. Rasmussen, Rajecki and Craft 1993; Knight et al. 2004; Morris, Knight and Lesley 2012; Maust-Mohl, Fraser and Morrison 2012). Although, research has shown that males are less likely to attribute complex emotions to animals such as depression, grief and love, than females (Walker et al. 2014) and there may be gender differences in emotional and cognitive orientations towards animals (Kellert and Berry 1987).

#### *Limitations and Future Directions*

This study involved a large sample because of the school-based questionnaire approach, however, self-report data have limitations such as social desirability, potential peer influence and demand characteristics. A benefit of taking a large-scale questionnaire study approach is that it facilitated the creation of Child-BAM, for use in other studies. Future research utilising experimental and/or observational methods would enhance our understanding of the role of BAM on behaviour. Although the family affluence measure demonstrated a low reliability within our sample, there are currently no alternative child self-report measures of family wealth.

The humane behaviour measure, as a whole, assessed reported behaviour rather than actual behaviour, which is a limitation. Furthermore, the sub-scale “aggression towards pets” was weakened by consisting of only one item, which may explain why no significant relationship was found. While there is a strong evidence base for the link between attitudes

and actual behaviour (see Armitage and Christian 2003 for a review) further research is required.

The children's attitudes towards animal cruelty measure (CAAC) used in this study is a novel measurement tool that offers an ethically sensitive way to explore children's orientations to animal cruelty. Asking children about actual cruelty is often not acceptable to schools or parents, and may be distressing for children and so this new measure was developed to provide child data on this important behaviour. While it has produced interesting findings, it should be noted that it did not focus on particular species and instead, focused on attitudes towards animal cruelty in general. Children may hold particular attitudes or feelings of morality towards certain species. For example, cruelty to dogs may be viewed as unacceptable, whereas cruelty to insects (for example stepping on ants) may be viewed as acceptable during curious childhood play (Ascione 2005). Further research investigating children's attitudes about cruelty to particular species and parental attitudes would be beneficial (Paul and Serpell 1993). It is worth noting that the item "kill an animal" may be interpreted differently (e.g. for food or for fun) and some children wrote next to this item "only for food". Future research could refine this item, for example altering it to "kill an animal not for food". A strength of the scale is that it included unintentional harm, and neglect in addition to intentional cruelty. This scale is analysed and presented in more detail in a separate publication (Hawkins and Williams, in preparation).

## *Conclusion*

This study reveals that children's beliefs about animal minds may underpin the factors relating to their humane treatment of animals, highlighting the important role of Child-BAM on children's attachment, compassion, humane behaviour, attitudes towards animals and

attitudes towards animal cruelty. Child-BAM is influenced by age, cognitive development and experience of pets and will be open to educational intervention. We have created a useful research and evaluation tool to measure Child-BAM that will aid future studies in this area. The development and evaluation of education materials designed to increase children's understanding of animal minds is required to promote positive and safe interactions between children and animals and prevent childhood animal cruelty.

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### References

- Allport, G. W. 1954. *The Nature of Prejudice*. Cambridge, MA: Beacon Press.
- Armitage, C. J., and Christian, J. 2003. From attitudes to behaviour: Basic and applied research on the theory of planned behaviour. *Current Psychology* 22(3): 187-195.
- Ascione, F. R. 1993. Children who are cruel to animals: a review of research and implications for developmental psychopathology. *Anthrozoös* 6(4): 226-247.
- Ascione, F.R. 2004. *Children and Animals: Exploring the Roots of Kindness and Cruelty*. Indiana, US: Purdue University Press.
- Baldry, A. C. 2005. Animal abuse among preadolescents directly and indirectly victimized at school and at home. *Criminal Behaviour and Mental Health* 15(2): 97-110.

480 Baron-Cohen, S. 2003. *The Essential Difference: Men, Women and the Extreme Male Brain*.  
 481 London, UK: Allen Lane.

482 Bartal, I.B.A., Decety, J., and Mason, P. 2011. Empathy and pro-social behavior in rats.  
 483 *Science* 334(6061): 1427-1430.

484 Bartal, I.B.A., Rodgers, D.A., Sarria, M.S.B., Decety, J., and Mason, P. 2014. Pro-social  
 485 behavior in rats is modulated by social experience. *Elife*, 3: e01385. DOI:  
 486 10.7554/eLife.01385#.dpuf.

487 Bjerke, T., Ødegårdstuen, T.S., and Kaltenborn, B.P. 1998. Attitudes toward animals among  
 488 Norwegian adolescents. *Anthrozoös* 11(2): 79-86.

489 Boissy, A., and Lee, C. 2014. How assessing relationships between emotions and cognition  
 490 can improve farm animal welfare. *Scientific and Technical Review* 33: 103-110.

491 Borgi, M., and Cirulli, F. 2015. Attitudes toward animals among kindergarten children:  
 492 Species preferences. *Anthrozoös* 28(1): 45-59.

493 Broida, J., Tingley, L., Kimball, R., and Miele, J. 1993. Personality differences between pro-  
 494 and antivivisectionists. *Society and Animals* 1(2): 129-144.

495 Brown, C. 2015. Fish intelligence, sentience and ethics. *Animal cognition* 18(1): 1-17.

496 Burghardt, G.M. 2009. Ethics and animal consciousness: how rubber the ethical ruler?  
 497 *Journal of Social Issues* 65: 499-521.

498 Burke, L.A., and Williams, J.M. 2009. Developmental changes in children's understandings  
 499 of intelligence and thinking skills. *Early Child Development and Care* 179(7): 949-968.

500 Burich, L. and Williams, J.M. Children's welfare knowledge and concerns about farm  
 501 animals: a qualitative study. *Society and Animals* (under review).

502 Cain, A.O. 1985. Pets as family members. *Marriage and Family Review* 8(3-4): 5-10.

503 Carey, S. 1985. *Conceptual Change in Childhood*. Massachusetts, US: Bradford Books, MIT  
504 Press.

505 Carporel, L.R. and Heyes, C.M. 1997. Why anthropomorphize? Folk psychologies and other  
506 stories. In *Anthropomorphism, Anecdotes and Animals*, 59-73, ed. R.W. Mitchell, N.S.  
507 Thompson, and H.L. Miles. Albany: State University of New York Press.

508 Cohen, J. 1988. *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale,  
509 NJ: Erlbaum.

510 Collins, T. 2012. Children's understanding of animal minds. Undergraduate thesis, University  
511 of Edinburgh, UK.

512 Connor, M., Williams, J.M., and Lawrence, A.C. 2014. Development of attitudes towards  
513 animals during adolescence. Paper presented at the British Psychological Society conference  
514 Developmental Section Conference, Amsterdam, NL, September 3-5, 2014.

515 Currie, C., Molcho, M., Boyce, B., Holstein, B., Torsheim, T. and Richter, M. 2008.  
516 Researching health inequalities in adolescents: the development of the health behaviour in  
517 school-aged children (HBSC) Family Affluence Scale. *Social Science and Medicine* 66:  
518 1429-1436.

519 Daly, B. and Morton, L.L. 2006. An investigation of human-animal interactions and empathy  
520 as related to pet preference, ownership, attachment, and attitudes in children. *Anthrozoos* 19:  
521 113-127.

522 Davis, S. L., and Cheeke, P. R. 1998. Do domestic animals have minds and the ability to  
523 think? A provisional sample of opinions on the question. *Journal of Animal Science* 76(8):  
524 2072-2079.



525 Dennett, D. C. 1978. Beliefs about beliefs. *Behavioral and Brain Sciences* 1(4): 568-570.

526 Driscoll, J. W. 1992. Attitudes towards animal use. *Anthrozoös* 5: 32–39.

527 Duncan, A., Thomas, J.C., and Miller, C. 2005. Significance of family risk factors in  
528 development of childhood animal cruelty in adolescent boys with conduct problems. *Journal*  
529 *of Family Violence* 20(4): 235-239.

530 Eddy, T.J., Gallup, G.G., and Povinelli, D.J. 1993. Attribution of cognitive states to animals:  
531 Anthropomorphism in comparative perspective. *Journal of Social Issues* 49(1): 87-101.

532 Ellingsen, K., Zanella, A.J., Bjerkås, E., and Indrebø, A. 2010. The relationship between  
533 empathy, perception of pain and attitudes toward pets among Norwegian dog  
534 owners. *Anthrozoös* 23(3): 231-243.

535 Fenton, D.M., and Hills, A.M. 1988. The perception of animals amongst animal liberationists  
536 and hunters. *Australian Psychologist* 23: 243-257.

537 Foster, P. 2015. Chimps deserve human rights, activists argue in New York.  
538 [http://www.telegraph.co.uk/news/worldnews/northamerica/usa/11634363/Chimps-deserve-](http://www.telegraph.co.uk/news/worldnews/northamerica/usa/11634363/Chimps-deserve-human-rights-activists-argue-in-New-York.html)  
539 [human-rights-activists-argue-in-New-York.html](http://www.telegraph.co.uk/news/worldnews/northamerica/usa/11634363/Chimps-deserve-human-rights-activists-argue-in-New-York.html). Accessed on May 27, 2015.

540 Fraser, J., Maust-Mohl, M., Morrison, R., Reiss, D., Knight, S., Ardalan, N. and Weiss, M.  
541 2013. A proposed transdisciplinary framework to align comparative psychology and social  
542 science research on animal minds.  
543 [http://www.newknowledge.org/pdf/Transdisciplinary%20Framework%20to%20Align%20Re-](http://www.newknowledge.org/pdf/Transdisciplinary%20Framework%20to%20Align%20Research%20on%20Animal%20Minds_TO%20SHARE_2013%2011%2026.pdf)  
544 [search%20on%20Animal%20Minds\\_TO%20SHARE\\_2013%2011%2026.pdf](http://www.newknowledge.org/pdf/Transdisciplinary%20Framework%20to%20Align%20Research%20on%20Animal%20Minds_TO%20SHARE_2013%2011%2026.pdf). Accessed on  
545 February 01, 2016.

546 Frick, P. J., Lahey, B.B., Loeber, R., Tannenbaum, L., Van Horn, Y., Christ, M. A. G., Hart,  
547 E. A., and Hanson, K. 1993. Oppositional defiant disorder and conduct disorder: A meta-

548 analytic review of factor analyses and cross-validation in a clinical sample. *Clinical*  
549 *Psychology Review* 12: 319-340.

550 Furnham, A. and Heyes, C. 1993. Psychology students' beliefs about animals and animal  
551 experimentation. *Personality and Individual Differences* 15: 1-10.

552 Gullone, E. 2014. An evaluative review of theories related to animal cruelty. *Journal of*  
553 *Animal Ethics* 4(1): 37-57.

554 Gullone, E., and Robertson, N. 2008. The relationship between bullying and animal abuse  
555 behaviors in adolescents: The importance of witnessing animal abuse. *Journal of Applied*  
556 *Developmental Psychology* 29(5): 371-379.

557 Hatano, G. and Inagaki, K. 2002. *Young Children's Thinking about Biological World*. New  
558 York, US: Psychology Press.

559 Hawkins, R.D. and Williams, J.M. Children's Attitudes towards Animal Cruelty (CAAC):  
560 Development and Socio-Demographic Variations. (In preparation).

561 Hawkins, R.D., Williams, J.M. and Scottish SPCA. The Impact of the 'Prevention through  
562 Education' Programme on Children's Knowledge, Attitudes, Beliefs about Animal Minds and  
563 Attitudes towards Animal Cruelty. *Journal of Applied Animal Welfare Science* (under  
564 review).

565 Hawkins, R.D., Hawkins, E.L. and Williams, J.M. Psychological Risk Factors for Childhood  
566 Animal Cruelty: A Systematic Review. *Society and Animals* (In Press).

567 Helton, W.S., & Helton, N.D. 2005. Changing animal and environmental attitudes with  
568 evidence of animal minds. *Applied Environmental Education and Communication* 4(4): 317-  
569 323.

570 Herzog, H.A. and Galvin, S. 1997. Common sense and the mental lives of animals: an  
 571 empirical approach. In *Anthropomorphism, Anecdotes and Animals*, 237–253. ed. R.W.  
 572 Mitchell. Albany: State University of New York Press.

573 Hills, A.M. 1995. Empathy and belief in the mental experience of animals. *Anthrozoös* 8(3):  
 574 132-142.

575 Hoffman, M.L. 1984. Empathy, its limitations, and its role in a comprehensive moral theory.  
 576 In *Morality, Moral Behavior, and Moral Development*, 283-302, ed. W. M. Kurtines and J. L.  
 577 Gewirtz. New York: John Wiley.

578 Hoffmann, H., Kessler, H., Eppel, T., Rukavina, S., and Traue, H. C. 2010. Expression  
 579 intensity, gender and facial emotion recognition: Women recognize only subtle facial  
 580 emotions better than men. *Acta Psychologica* 135(3): 278-283.

581 Hornstein, H.A. 1976. *Cruelty and Kindness: A New Look at Aggression and Altruism*.  
 582 Englewood Cliffs, NJ: Prentice Hall.

583 Johnson, T.P., Garrity, T.F. and Stallones, L. 1992. Psychometric evaluation of the Lexington  
 584 Attachment to Pets Scale (LAPS). *Anthrozoös* 5: 160-175.

585 Kalof, L., Dietz, T., Stern, P.C. and Guagnano, G. A. 1999. Social psychological and  
 586 structural influences on vegetarian beliefs. *Rural Sociology* 64: 500–511.

587 Katcher, A. H. 1981. Interactions between people and their pets: form and function. In  
 588 *Interrelations between People and Pets*, 41-67, ed. B. Fogle. Springfield IL: Charles C  
 589 Thomas.

590 Kellert, S. R. and Berry, J. K. 1987. Attitudes, knowledge, and behaviors toward wildlife as  
 591 affected by gender. *Wildlife Society Bulletin* 15: 363–371.

592 Kielland, C., Skjerve, E., Østerås, O. and Zanella, A. J. 2008. Dairy farmers' assessment of  
 593 animal pain, using a photo-based instrument, can predict animal welfare outcomes at farm  
 594 level. In *Proceedings of the 42nd Congress of the International Society for Applied Ethology*,  
 595 226, ed. L. Boyle, N. O'Connell and A. Hanlon. Dublin: Wageningen Pers.

596 Kiesler, S., Lee, S., and Kramer, A. 2007. Relationship effects in psychological explanations  
 597 of nonhuman behaviour. *Anthrozoös* 19: 335-352.

598 Knight S., Vrij, A., Cherryman, J. and Nunkoosing, K. 2004. Attitudes toward animal use and  
 599 belief in animal mind. *Anthrozoös* 17: 43-62.

600 Knight, S., Vrij, A., Bard, K., and Brandon, D. 2009. Science versus human welfare?  
 601 Understanding attitudes toward animal use. *Journal of Social Issues* 65(3): 463-483.

602 Kruger, K., McCune, S., and Merrill, R. 2012. WALTHAM pocket book of human-animal  
 603 interactions. Leicester: Beyond Design Solutions Ltd.

604 Lim, A.K., Williams, J.M., Cebula, K., and Annaz, D. 2010. Cultural variations in naïve  
 605 psychology among 2-year-olds: A comparison of children in the United Kingdom and  
 606 Singapore. *Journal of Cognition and Culture* 10(3-4): 221-251.

607 Lockard, R. B. 1971. Reflections on the fall of comparative psychology: Is there a message  
 608 for us all? *American Psychologist* 26(2): 168-179.

609 Mariti, C., Papi, F., Mengoli, M., Moretti, G., Martelli, F., and Gazzano, A. 2011.  
 610 Improvement in children's humaneness toward nonhuman animals through a project of  
 611 educational anthrozoology. *Journal of Veterinary Behavior: Clinical Applications and*  
 612 *Research* 6(1): 12-20.

613 Marsa-Sambola, F., Muldoon, J., Williams, J., Lawrence, A., Connor, M. and Currie, C.  
 614 2015. The Short Attachment to Pets Scale (SAPS) for children and young people:

615 development, psychometric qualities and demographic and health Associations. *Child*  
616 *Indicators Research*: 1-21.

617 Maust-Mohl, M., Fraser, J., and Morrison, R. 2012. Wild Minds: What people think about  
618 animal thinking. *Anthrozoös* 25(2): 133-147.

619 Melson, G. F. 2003. Child development and the human-companion animal bond. *American*  
620 *Behavioral Scientist* 47(1): 31-39.

621 Melson, G. F., and Melson, L. G. 2009. *Why the Wild Things Are: Animals in the Lives of*  
622 *Children*. Massachusetts, US: Harvard University Press.

623 Miles, J., and Shevlin, M. 2001. *Applying Regression and Correlation: A Guide for Students*  
624 *and Researchers*. London, UK: Sage Publications.

625 Morris, P., Knight, S., and Lesley, S. 2012. Belief in animal mind: Does familiarity with  
626 animals influence beliefs about animal emotions? *Society and Animals* 20(3): 211-224.

627 Muldoon, J., Williams, J.M., Lawrence, A., Lakestani, N., & Currie, C. (2009). Promoting a  
628 ‘duty of care’ towards animals among children and young people: A literature review and  
629 findings from initial research to inform the development of interventions (Commissioned by  
630 Defra, p.107). Child and Adolescent Health Research Unit, University of Edinburgh, UK.

631 Muldoon, J.C., Williams, J.M. and Lawrence, A. 2015. ‘Mum cleaned it and I just played  
632 with it’: Children’s perceptions of their roles and responsibilities in the care of family pets.  
633 *Childhood* 22(2): 201-216.

634 Munsell, K.L., Canfield, M., Templer, D.I., Tangan, K. and Arikawa, H. 2004. Modification  
635 of the Pet Attitude Scale. *Society and Animals* 12: 137-142.

636 Myers, O. G. 1998. *Children and Animals: Social Development and Our Connections to*  
637 *Other Species*. Colorado, US: Westview Press.

638 Nakajima, S., Arimitsu, K., and Lattal, K. M. 2002. Estimation of animal intelligence by  
639 university students in Japan and the United States. *Anthrozoös* 15(3): 194-205.

640 Neff, K. D. 2003. The development and validation of a scale to measure self-compassion. *Self*  
641 *and Identity* 2(3): 223-250.

642 Okamoto, C. M. 2001. Opinions on animal use in medical research and entertainment. Ph.D  
643 thesis, University of Toronto.

644 Paul, E.S. and Serpell, J. 1993. Childhood pet keeping and humane attitudes in young  
645 adulthood. *Animal Welfare* 2: 321-337.

646 Peterson, D. 2011. *The Moral Lives of Animals*. New York: Bloomsbury Press.

647 Plous, S. 1993. Psychological mechanisms in the human use of animals. *Journal of Social*  
648 *Issues* 49: 11-52.

649 Poresky, R. H. and Hendrix, C. 1990. Differential effects of pet presence and pet-bonding on  
650 young children. *Psychological Reports* 67: 51-54.

651 Rasmussen, J. L., Rajecki, D. W., and Craft, H. D. 1993. Humans' perceptions of animal  
652 mentality: ascriptions of thinking. *Journal of Comparative Psychology* 107(3): 283-290.

653 Rumbaugh, D. M. 2014. *Language Learning by a Chimpanzee: The Lana project*.  
654 Massachusetts, US: Academic Press.

655 Sanders, C. R. 2003. Actions speak louder than words: close relationships between humans  
656 and nonhuman animals. *Symbolic Interaction* 26(3): 405-426.

657 Saracho, O. N. 2014. Theory of mind: children's understanding of mental states. *Early Child*  
658 *Development and Care* 184(6): 949-961.

- 659 Sorabji, R. 1995. *Animal Minds and Human Morals: The origins of the Western Debate*.  
660 Ithaca, US: Cornell University Press.
- 661 Staub, E. 1987. Commentary on Part I. In *Empathy and its Development*, 103-115.  
662 Cambridge: Cambridge University Press.
- 663 Thompson, K.L. and Gullone, E. 2003. The children's treatment of animals questionnaire  
664 (CTAQ): A psychometric investigation. *Society and Animals 11*: 1-15.
- 665 Vanhonacker, F., Van Poucke, E., Tuytens, F., & Verbeke, W. 2010. Citizens' views on farm  
666 animal welfare and related information provision: Exploratory insights from Flanders,  
667 Belgium. *Journal of Agricultural and Environmental Ethics 23*(6): 551-569.
- 668 Walker, J. K., McGrath, N., Nilsson, D. L., Waran, N. K., and Phillips, C. J. 2014. The Role  
669 of gender in public perception of whether animals can experience grief and other emotions.  
670 *Anthrozoös 27*(2): 251-266.
- 671 Whittle, S., Yücel, M., Yap, M. B., and Allen, N. B. 2011. Sex differences in the neural  
672 correlates of emotion: evidence from neuroimaging. *Biological Psychology 87*(3): 319-333.
- 673 Wilkins, A. M., McCrae, L. S. and McBride, E. A. 2015. Factors affecting the human  
674 attribution of emotions toward animals. *Anthrozoös 28*(3): 357-369.

**Table 1.** Principal components analysis with varimax rotation showing variable loadings on each component extracted from analyses (N = 1217). High loadings are in bold.

Item from the Children's Reported Humane Behaviour towards Animals (CRHBA) Measure	Component		
	1	2	3
Pat/stroke	<b>0.835</b>	0.154	0.179
Cuddle	<b>0.821</b>	0.245	0.064
Play	<b>0.777</b>	0.240	0.084
Take for a walk	<b>0.645</b>	0.074	-0.371
Groom (comb hair)	<b>0.642</b>	0.336	-0.142
Spend time with	<b>0.613</b>	0.391	0.229
Allow to stay in room	<b>0.509</b>	0.192	0.032
Tell secrets to	0.189	<b>0.779</b>	-0.111
Give food or water to	0.093	<b>0.645</b>	0.040
Cry with when sad	0.366	<b>0.609</b>	-0.025
Talk to	0.341	<b>0.599</b>	0.236
Shout at	0.075	0.027	<b>0.886</b>



**Table 2.** Principal components analysis with varimax rotation showing variable loadings on each component extracted from analyses (N = 1217). High loadings are in bold.

Item from the Children's Attitudes towards Animal Cruelty (CAAC) measure	Component		
	1	2	3
Hurt on purpose	<b>0.810</b>	-0.040	0.115
Kick on purpose	<b>0.719</b>	-0.047	0.142
Frighten on purpose	<b>0.698</b>	0.155	-0.064
Annoy on purpose	<b>0.679</b>	0.050	0.010
Tease	<b>0.611</b>	0.120	-0.003
Kill	<b>0.429</b>	0.130	0.221
Kick accidentally	-0.021	<b>0.911</b>	0.117
Hurt accidentally	0.009	<b>0.888</b>	0.173
Leave alone for a few days	0.210	<b>0.457</b>	0.040
Forget to give water	0.066	0.163	<b>0.921</b>
Forget to feed	0.109	0.129	<b>0.919</b>

**Table 3.** Phylogenetic differences in ratings of sentence in ascending order

Animal In order of intelligence	Clever Mean	SD	Animal In order of ability to feel pain	Pain Mean	SD	Animal In order of ability to feel happiness	Happiness Mean	SD	Animal In order of ability to feel sadness	Sadness Mean	SD	Animal In order of ability to feel fear	Fear Mean	SD
Human	1.15	0.6	Human	1.08	0.4	Human	1.05	0.3	Human	1.07	0.4	Human	1.09	0.4
Dog	1.3	0.7	Dog	1.15	0.7	Dog	1.08	0.4	Dog	1.14	0.5	Dog	1.13	0.6
Chimpanzee	1.72	1.1	Chimpanzee	1.42	0.8	Chimpanzee	1.43	0.8	Chimpanzee	1.55	0.9	Chimpanzee	1.47	0.9
Robin	2.1	1	Cow	1.53	0.9	Robin	1.71	1	Robin	1.83	1	Robin	1.51	0.8
Badger	2.18	1.1	Robin	1.56	0.9	Badger	1.8	1	Badger	1.84	1	Cow	1.59	1
Frog	2.67	1.2	Badger	1.6	1	Cow	1.89	1	Cow	1.9	1.1	Badger	1.59	0.9
Cow	2.96	1.2	Frog	1.75	1	Goldfish	1.93	1.2	Goldfish	2	1.2	Frog	1.73	1
Goldfish	2.97	1.4	Goldfish	1.81	1.1	Frog	1.99	1.1	Frog	2.04	1.4	Goldfish	1.78	1.1

*Note: Scores are reversed, low scores= high sentence, high scores= low sentence*

**Table 4.** Results from simple linear regression analysis investigating children's beliefs about animal minds (Child-BAM).

Variables	df	F	p	Predictors of Child-BAM			Variables that Child-BAM predicts		
				r	VE %	B	r	VE %	B
Family affluence	988	0.14	0.71	0.012	0	0.000	0.004	0	-0.06
Attachment to pets	1081	38.1	< 0.001	0.19	3.4	0.14	0.19	3.4	0.24
Reported humane behaviour	1069	31.41	< 0.001	0.17	2.9	0.16	0.17	2.9	0.18
Caring behaviour (sub-scale)	1068	15.65	< 0.001	0.12	1.4	0.01	0.12	1.4	1.1
Emotional attachment (sub-scale)	1068	8.72	0.003	0.09	0.8	0.01	0.09	0.8	0.77
Aggression towards pets (sub-scale)	1069	0.044	0.834	0.006	0	0.001	0.006	0	0.06
Attitudes towards animals	970	64.42	< 0.001	0.25	6.2	0.37	0.25	6.3	0.17
Attitudes towards pets	1062	26.43	< 0.001	0.16	2.4	0.21	0.16	2.4	0.12
Attitudes towards wild animals	1042	57.5	< 0.001	0.23	5.2	0.21	0.23	5.2	0.26
Attitudes towards farm animals	1010	27.6	< 0.001	0.16	2.7	0.004	0.16	2.6	5.8
Compassion to animals	1047	17.3	< 0.001	0.13	1.6	0.01	0.13	1.6	0.16
Attitudes towards animal cruelty	1081	20.24	< 0.001	0.14	1.8	0.13	0.14	1.8	0.14
Intentional animal cruelty (sub-scale)	1080	12.2	0.001	0.11	1.1	0.01	0.11	1.1	0.88
Unintentional animal cruelty (sub-scale)	1080	7.34	0.007	0.08	0.7	0.01	0.08	0.7	0.7
Animal neglect (sub-scale)	1080	6.7	0.01	0.08	0.6	0.01	0.08	0.6	0.68

Notes: VE= variance explained

**Table 5.** One-way ANOVA results for differences in Child-BAM between items from the attachment to pets (SAPS) measure.

Item from the attachment to pets measure	One-way ANOVA	Post-Hoc
I don't really like animals	$F(4,1108)=9, p=0.000, n^2=0.03$	SD, NS $p=0.001$ SD, SA $p=0.038$ SD, D $p<0.001$
I spend time every day playing with my pet (or would if I had one)	<i>Welch's' F</i> (4,127)=6.3, $p<0.001$	SA, NS $p<0.001$ A, NS $p=0.04$ SA, A $p=0.026$
I have sometimes talked to my pet and understood what it was trying to tell me (or would if I had one)	$F(4,1105)=1.69, p=0.151, n^2=0.01$	<i>Ns</i>
I love pets	<i>Welch's' F</i> (4,58)=2.43, $p=0.058$	<i>Ns</i>
I talk to my pet quite a lot (or would if I had one)	$F(4,1103)=6.92, p<0.001, n^2=0.02$	SA, NS $p<0.001$ A, NS $p=0.025$
My pet makes me feel happy (or would if I had one)	$F(4,1105)=5.4, p<0.001, n^2=0.02$	SA, NS $p=0.029$
I consider my pet to be a friend (or would if I had one)	$F(4,1104)=6.36, p<0.001, n^2=0.02$	SA, NS $p=0.024$ A, NS $p=0.019$
My pet knows when I am upset and tries to comfort me (or would if I had one)	$F(4,1106)=2.24, p=0.063, n^2=0.01$	<i>Ns</i>
There are times I'd be lonely without my pet (or would if I had one)	$F(1103)=3.4, p=0.009, n^2=0.01$	SA, NS $p=0.019$

*Notes: SA= strongly agree, A=agree, NS= not sure, SD=strongly disagree. Ns=not significant.*

**Table 6.** One-way ANOVA results for differences in children's beliefs about animal minds (Child-BAM) between items from the children's reported humane behaviour towards animals measure (CRHBA).

Item from the children's reported humane behaviour towards animals measure	One-way ANOVA	Post-Hoc
Play with	$F(3,1114)=8.5, p<0.001, n^2=0.02$	O, S $p<0.001$
Give food or water to	$F(3,1114)=1.2, p=0.304, n^2=0.003$	Ns
Take for a walk	$F(3,1106)=7.7, p<0.001, n^2=0.02$	O, S $p<0.001$ O, N $p=.005$
Pat/stroke	$F(3,1110)=6.53, p<0.001, n^2=0.02$	O, S $p=0.002$
Shout at	$F(3,1109)=1.1, p=0.369, n^2=0.003$	Ns
Cuddle	$F(3,1105)=5.93, p=0.001, n^2=0.02$	O, S $p=0.002$
Cry with when I am sad	$F(3,1100)=3.4, p=0.018, n^2=0.01$	O, C $p=0.018$
Talk to	$F(3,1110)=3.44, p=0.016, n^2=0.01$	Ns
Allow to stay in my room	$F(3,1112)=2.8, p=0.038, n^2=0.01$	Ns
Groom (comb hair)	$F(4,1107)=8.99, p<0.001, n^2=0.02$	O, S $p=0.001$ O, N $p<0.001$ O, C $p=0.002$
Tell my secrets to	$F(3,1106)=4.2, p=0.006, n^2=0.01$	O, N $p=0.019$
Spend time with	$F(3,1106)=6.94, p<0.001, n^2=0.02$	O, S $p<0.001$

*Note: O=often, S=sometimes, N=never, C= I cannot do this with my animal(s); Ns=not significant*